

Indicator: Bird Populations (340)

Bird populations are among the most visible and important biological components of ecosystems, and provide important ecological services including seed dispersal, plant pollination and pest control. Some birds migrate over entire continents, while others have more restricted ranges and habitats, but in all cases trends in bird populations and in the abundance of species integrate the influences of changes in landscape and habitat, the availability and quality of food, toxic chemicals, and climate. The North American Breeding Bird Survey (BBS) began in 1966 with approximately 600 surveys conducted in the U.S. and Canada east of the Mississippi River. Today there are approximately 3,700 active BBS routes across the continental U.S. and southern Canada (Sauer et al., 1997: <http://www.mbr-pwrc.usgs.gov/bbs/genintro.html>).

Trends have been computed for observed population sizes of 654 bird species for the period 1966-2003 (Sauer et al 2004 <http://www.mbr-pwrc.usgs.gov/bbs/bbs.html>). The Audubon Society, 2004, <http://www.audubon.org/bird/stateofthebirds/> categorized each species according to its primary habitat: grassland, shrubland, woodland, urban, and water and wetlands. This indicator reflects the numbers of species for which adequate trend data exist in which population counts significantly increased or decreased between 1996 and 2003. “Significant” increases or decreases were defined for this study as those in which the observed populations on BBS routes increased or decreased by more than two-thirds between 1966 and 2003.

What the Data Show

The results point to dynamic changes in bird populations in all habitat types (Figure 340-1), although there were no consistent changes in direction.

- Of 47 grassland species, only 4% showed significant population increases and 40% showed significant decreases, and of 107 shrubland species, 11% showed significant increases, while 26% showed significant declines.
- Of 104 woodland species, 29% showed significant populations increases and 26% showed significant decreases, and of 45 primarily urban species, 38% showed significant population increases and 22% had significant decreases.
- Of 268 water and wetland bird species, 14% showed significant increases and 5% showed significant decreases.

Indicator Limitations

- The BBS produces an index of relative abundance rather than a complete count of breeding bird populations. The data analyses assume that fluctuations in these indices of abundance are representative of the population as a whole.
- The BBS data do not provide an explanation for the causes of population trends. To evaluate population changes over time, BBS indices from individual routes are combined to obtain regional and continental estimates of trends. Although some species have consistent trends throughout the history of the BBS, most do not. For example, populations of permanent resident and short-distance migrant species (birds wintering primarily in the U.S. and Canada) are adversely affected by periodic episodes of unusually harsh winter weather.

- Few species have consistent population trends across their entire ranges, so increases or decreases in this indicator may not reflect the situation across the entire range of the species.

Data Sources

The data sources for this indicator were The U.S. Geological Survey National Breeding Bird Survey (<http://www.pwrc.usgs.gov/bbs/retrieval/menu.cfm>, <http://www.pwrc.usgs.gov/bbs/index.html>).

References

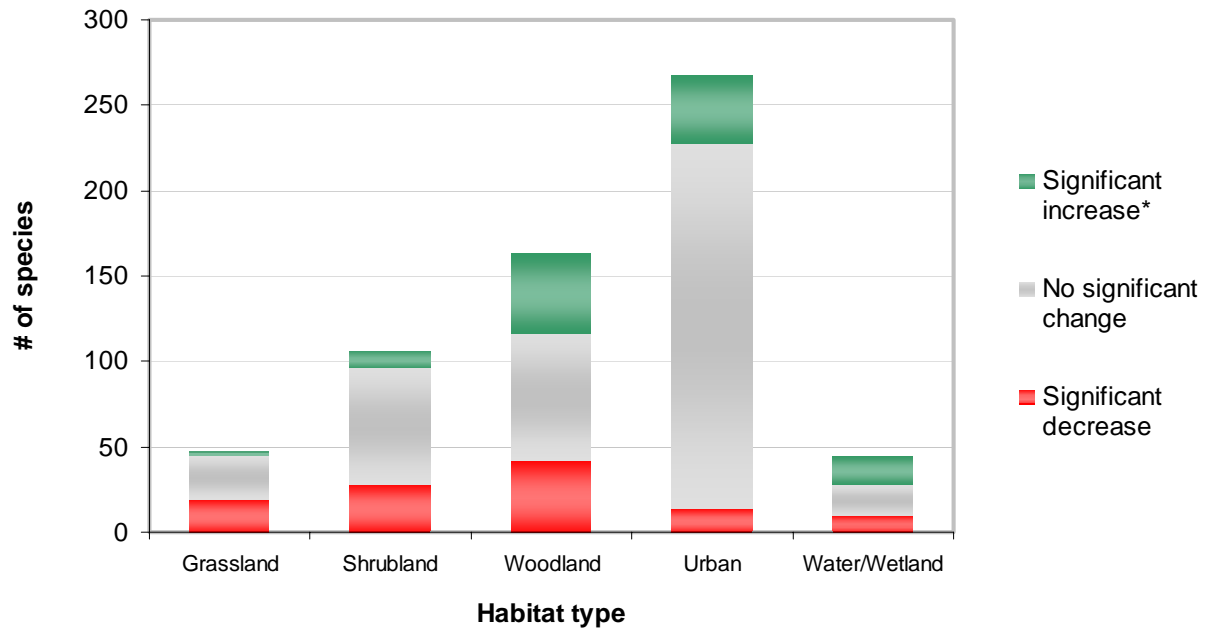
Audubon Society. 2004. State of the Birds USA 2004. *Audubon Magazine*. September-October 2004.

Sauer, J. R., J. E. Hines, G. Gough, I. Thomas, and B. G. Peterjohn. 1997. *The North American Breeding Bird Survey, Results and Analysis. Version 96.4. USGS Patuxent Wildlife Research Center, Laurel, MD.*

Sauer, J. R., J. E. Hines, and J. Fallon. 2004. *The North American Breeding Bird Survey, Results and Analysis 1966 - 2003. Version 2004.1. USGS Patuxent Wildlife Research Center, Laurel, MD.*

Graphics

Figure 340-1. Numbers of bird species with significant increases, significant decreases, or no significant changes - 1966-2003



* "Significant" increases or decreases are those in which the observed populations on BBS routes increased or decreased by more than two-thirds between 1966 and 2003.

Changes in bird populations, 1966-2003

Source: Sauer, J. R., J. E. Hines, and J. Fallon. 2004. The North American Breeding Bird Survey, Results and Analysis 1966 - 2003. Version 2004.1. USGS Patuxent Wildlife Research Center, Laurel, MD.
Coverage: lower 48 states and southern portions of Canada

R.O.E. Indicator QA/QC

Data Set Name: BIRD POPULATIONS

Indicator Number: 340 (89685)

Data Set Source: U.S. Geological Survey Breeding Bird Survey (BBS)

Data Collection Date: regular: 1966 - 2003

Data Collection Frequency: 1yr.

Data Set Description: Bird Populations

Primary ROE Question: What are the trends in the diversity and biological balance of the Nation's ecological systems?

Question/Response

T1Q1 Are the physical, chemical, or biological measurements upon which this indicator is based widely accepted as scientifically and technically valid?

Yes. This indicator is based on the U.S. Geological Survey Breeding Bird Survey (BBS). The BBS is a long-term, large-scale, international avian monitoring program initiated in 1966 to track the status and trends of North American bird populations. Participants skilled in avian identification collect bird population data along roadside survey routes each year during the height of the avian breeding season (June for most of the U.S.). See <http://www.mbr-pwrc.usgs.gov/bbs/genintro.html> for details. (See T1Q3 for peer review results.)

T1Q2 Is the sampling design and/or monitoring plan used to collect the data over time and space based on sound scientific principles?

Each survey route is 24.5 miles long with stops at 0.5-mile intervals. At each stop, a 3-minute point count is conducted. During the count, every bird seen within a 0.25-mile radius or heard is recorded. Surveys start one-half hour before local sunrise and take about 5 hours to complete. Over 4100 survey routes are located across the continental U.S. and Canada. Trend estimates for more than 420 bird species and all raw data are currently available via the BBS web site. See <http://www.mbr-pwrc.usgs.gov/bbs/genintro.html> for details. (See T1Q3 for peer review results.)

T1Q3 Is the conceptual model used to transform these measurements into an indicator widely accepted as a scientifically sound representation of the phenomenon it indicates?

Trend estimates for more than 420 bird species and all raw data are currently available via the BBS web site. Analytical models for the trend data are presented by Sauer, J. R., J. E. Hines, and J. Fallon. 2004. The North American Breeding Bird Survey, Results and Analysis 1966 - 2003. Version 2004.1. USGS Patuxent Wildlife Research Center, Laurel, MD. In April 1999, a Review Panel was commissioned by the USGS Patuxent Wildlife Research Center to review the scientific and operational aspects of the U.S. Breeding Bird Survey (BBS). The Panel's report consisting of 31 recommendations was released in February 2000 and is presented at <http://www.pwrc.usgs.gov/bbs/bbsreview/> in its entirety, along with the implementation plan addressing each of the recommendations. The Audubon Society, 2004, <http://www.audubon.org/bird/stateofthebirds/> categorized each population according to its primary habitat: grassland, shrubland, woodland, urban, and water and wetlands. This indicator reflects the number of species whose populations significantly increased or decreased over that time period.

T2Q1 To what extent is the indicator sampling design and monitoring plan appropriate for answering the relevant question in the ROE?

The relevant question asks about trends in the diversity and biological balance of ecosystems. Bird populations are an important component of biological diversity, and the design design of the BBS was deemed to be highly appropriate to tracking trends in bird populations by the BBS peer review: <http://www.pwrc.usgs.gov/bbs/bbsreview/>.

T2Q2 To what extent does the sampling design represent sensitive populations or ecosystems?

The indicator is not sensitive to bird populations with relatively low abundance, which may represent the most sensitive or threatened species.

T2Q3 Are there established reference points, thresholds or ranges of values for this indicator that unambiguously reflect the state of the environment?

This indicator compares trends in relative abundances over the period of record, and does not identify any independent reference point relative to trends before this time or the extent to which the observed trends are natural or influenced by human alteration of the environment.

T3Q1 What documentation clearly and completely describes the underlying sampling and analytical procedures used?

Analytical procedures for making bird counts along the BBS routes are documented on the BBS website at <http://www.mbr-pwrc.usgs.gov/bbs/instruct.html>. Sampling procedures (placement of routes) is described at <http://www.mbr-pwrc.usgs.gov/bbs/genintro.html>. Trend analyses are documented in: Geissler, P.H., and J.R. Sauer. 1990. Topics in route-regression analysis. Pp. 54-57 in J.R. Sauer and S. Droege (eds.) Survey designs and statistical methods for the estimation of avian population trends. U.S. Fish Wildl. Serv., Biol. Rep. 90(1). Link, W. A., and J. R. Sauer. 1994. Estimating equations - estimates of trend. Bird Populations 2:23-32.

T3Q2 Is the complete data set accessible, including metadata, data-dictionaries and embedded definitions or are there confidentiality issues that may limit accessibility to the complete data set?

Data for the BBS are readily available at <http://www.pwrc.usgs.gov/bbs/retrieval/disclaim.cfm>.

T3Q3 Are the descriptions of the study or survey design clear, complete and sufficient to enable the study or survey to be reproduced?

The survey design, along with maps of the BBS routes, is documented at <http://www.mbr-pwrc.usgs.gov/bbs/genintro.html>.

T3Q4 To what extent are the procedures for quality assurance and quality control of the data documented and accessible?

Data quality in the BBS is dependent on the volunteer observer force. BBS personnel take pains to provide detailed guidance to BBS personnel and to maintain a trained cadre of observers, but age (hearing loss necessary to distinguish calls), and youth of some observers can cause data problems. The BBS peer review recommended that the BBS publish, either via the Web or in the literature, an assessment for every species represented in the BBS database, indicating geographic, temporal, and other major limitations in sampling that affect quality or generality of

trend estimates. All PWRC web sites presenting BBS results should indicate which species have had such limitations identified (preferably linking to the specific details)

<http://www.pwrc.usgs.gov/bbs/bbsreview/>. See also Sauer, J. R., B. G. Peterjohn, and W. Link. 1994. Observer differences in the North American Breeding Bird Survey. *The Auk* 111: 50-62.

T4Q1 Have appropriate statistical methods been used to generalize or portray data beyond the time or spatial locations where measurements were made (e.g., statistical survey inference, no generalization is possible)?

The large number of BBS routes and geographic coverage suggest that for most of the species, trends noted in the indicator should be reasonably generalizable, but obviously cannot be extrapolated to species not observed on the routes. But see the limitations in T4Q4.

T4Q2 Are uncertainty measurements or estimates available for the indicator and/or the underlying data set?

Uncertainties arise from a combination of differential coverage of BBS routes over time and space; efficiencies in sampling birds not sampled by the BBS, birds with a small sample-size, highly variable bird populations, or species with low relative abundance; and with statistical estimation of trends. These issues are discussed in detail at: <http://www.mbr-pwrc.usgs.gov/bbs/introbbs.html>.

T4Q3 Do the uncertainty and variability impact the conclusions that can be inferred from the data and the utility of the indicator?

Overall, 204 (41%) of the 504 species we analyzed for 25-year trends were in at least one of the categories listed in T4Q2 (small sample size, highly variable populations, or low relative abundances). The guild with the lowest proportion of species in the lists was urban species (8%), while hunted, wetland nesting, and waterfowl guilds had > 41% of their species in 1 of the 3 categories <http://www.mbr-pwrc.usgs.gov/bbs/introbbs.html>.

T4Q4 Are there limitations, or gaps in the data that may mislead a user about fundamental trends in the indicator over space or time period for which data are available?

All BBS analyses incorporate data only from BBS routes. Analysis of survey data cannot tell us the proportion of the individuals of a species that is breeding outside the range of the survey. Species that are recorded only on the margins of the surveyed area are often of low sample size or are highly variable, but many species (e.g., Canada Goose) may have substantial populations within the survey area. Trends are always specific to the areas surveyed. Roadside biases. The BBS is a roadside survey, and a major criticism of the survey has been that habitat changes along roadsides may not be representative of regional habitat changes. Trends from the BBS may therefore reflect only populations along roads rather than regional bird population changes. Within the range of the BBS, many habitats are not well covered, and species that populate those habitats are poorly sampled. Wetland birds and species occupying alpine tundra habitats are examples of groups thought to be poorly represented in the survey. Additional limitations described below are documented at <http://www.mbr-pwrc.usgs.gov/bbs/introbbs.html>, and are based on the following sources: Bystrak, D. 1981. The North American Breeding Bird Survey. Pp. 34-41 in C. J. Ralph and J. M. Scott, eds. Estimating numbers of terrestrial birds. *Studies in Avian Biol.* No. 6. Droege, S. 1990. The North American Breeding Bird Survey. Pp. 1-4 in J. R. Sauer and S. Droege, eds. Survey designs and statistical methods for the estimation of avian population trends. U.S. Fish Wildl. Serv. Biol. Rep. 90(1). The BBS produces an index of relative

abundance rather than a complete count of breeding bird populations. The data analyses assume that fluctuations in these indices of abundance are representative of the population as a whole. The BBS data do not provide an explanation for the causes of population trends. To evaluate population changes over time, BBS indices from individual routes are combined to obtain regional and continental estimates of trends. Although some species have consistent trends throughout the history of the BBS, most do not. For example, populations of permanent resident and short-distance migrant (birds wintering primarily in the U.S. and Canada) species are adversely affected by periodic episodes of unusually harsh winter weather. Few species have consistent trends across their entire ranges, so geographic patterns in trends are of considerable interest to anyone concerned with the status of the continent's birds.